Management Control Systems as a Package: an application to Science & Technology Parks. The UPTEC Case Study

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Abstract:

Management Control Systems (MCS) in Science and technology parks are likely to assume specific characteristics, as on this type of setting we can find shared administration with different organizations with different visions and objectives. At stake is both the management of a network of relationships and the management of behaviors within the organizations belonging to that network.

The idea of MCS working as a package is not a new one. In the course of recent decades, there have been a lot of calls to study this phenomenon Chenhall and Euske (2007), and various MCS frameworks have been proposed (Ferreira & Otley, 2009; Flamholtz, 1983; Flamholtz, Das, & Tsui, 1985; Malmi & Brown, 2008; Merchant & Van der Stede, 2011; Otley, 1980; Simons, 1995). These frameworks provide insights into what constitutes a MCS package. However, few studies have addressed why specific management control components work in the management of organizations in the context of networks. This is especially true in the case of STPs, whose managers seek to catalyse the arrangement of ties & networks between tenants (Boekholt & Thuriaux, 1999; Cooke, 1996; Hansson, Husted, & Vestergaard, 2005; Yang, Motohashi, & Chen, 2009).

The exploration of MCSs in STPs has been scarce, a gap that the present dissertation aims to fill. In fact, a model of MCSs in STPs is provided, on basis of a case study conducted in UPTEC, which is the STP of the University of Porto, Portugal. It describes the package of controls used in UPTEC and the rationales for the specific features this package assumes. I found that the roles of personal relationships and informality networking are very important within STPs. I also found that cultural barriers are not a major problem in UPTEC, which seems to contradict literature that identifies 'cultural barriers' as a common problem within this type of organization. Furthermore, I found that the internal networking of STPs can be efficiently controlled if the level of heterogeneity among tenants (incubated startups) is high, since this leads to low levels of competition and high levels of cooperation between them.

Key-words: Networks, Management Control Systems, Package of Management Control science and technology parks.

Resumo:

Os Sistemas de Controlo de Gestão (SCG) em Parques de Ciência e Tecnologia (PCTs) tendem a assumir características específicas, dada a administração partilhada de diferentes organizações com diferentes visões e objetivos, típica deste tipo de contexto. Em causa está a gestão de uma rede de relacionamentos e a gestão de comportamentos das organizações pertencentes à rede.

A ideia de SCG como 'pacote' (package) não é nova. Em décadas recentes têm sido vários os autores que apontaram a necessidade de estudar este fenómeno (Chenhall e Euske 2007), e vários quadros teóricos foram desenvolvidos (Ferreira & Otley, 2009; Flamholtz, 1983; Flamholtz et al., 1985; Malmi & Brown, 2008; Merchant & Van der Stede, 2011; Otley, 1980; Simons, 1995). Estes quadros teóricos fornecem indicações sobre o que constitui um pacote de SCG. Porém, poucos estudos têm abordado esta questão no contexto de redes. Esta situação é especialmente verdadeira no caso de PCTs, cujos gestores procuram catalisar o estabelecimento de ligações e de redes entre inquilinos (Boekholt & Thuriaux, 1999; Cooke, 1996; Hansson et al., 2005; Yang et al., 2009).

A exploração de SCG em PCTs tem sido escassa na literatura, sendo esta uma lacuna que a presente tese procura preencher. É apresentado um modelo de SCG em PCTs, com base nume studo de caso conduzido na UPTEC, que é o PCT da Universidade do Porto. É descrito o pacote de controlos utilizados na UPTEC e os fatores que justificam as características específicas que este pacote assume. Conclui-se que as relações pessoais e redes informalidade são muito importantes no context de PCTs. Conclui-se também que as barreiras culturais não constituem um problema nesta organização, ao contrário daquilo que a literature parece apontar. Finalmente, conclui-se que a rede de um PCT pode ser eficazmente controlada, nomeadamente se o nível de heterogeneidade entre os inquilinos (start-ups e incubadas) for elevado, dado que tal conduz a baixos níveis de competição e a altos níveis de cooperação.

Palavras-chaves: Redes, Sistemas de Controlo de Gestão, Pacote de Controlos, Parques Científicos e Tecnológicos.

List of acronyms:

MCS: Management Control Systems

PMS: Performance Management Systems

STP: Science and Technology Park

UPTEC: Science & Technology Park of Porto University

ISAP: International Association of Science Parks and Areas of Innovation

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Chapter 1 - Introduction

Management control systems in the past were merely envisaged as coordination systems, aiming at confronting actual performance with desired one, comparing results, and taking corrective actions in case of deviations. Now MCS assume a broader vision, involving aspects such as empowerment and encouragement, in order to lead employees to behave in a manner consistent with the organization's interests. Also, it is now accepted that MCS are about taking proactive precautions to prevent problems before their appearance (Merchant & State, 2012) .

Despite considerable developments in MCS literature in recent decades, there is still much to know about the workings of MCS, especially in 'special' organizational settings. This thesis aims to fill a gap found in the literature, regarding the MCS in the context of networks, and especially in the context of Science and Technology Parks (STP) (Albahari, P´erez-Canto, & Landoni, 2010; Ferreira & Otley, 2009; Malmi & Brown, 2008; Marques, Ribeiro, & Scapens, 2011; Pernot & Roodhooft, 2014)

My aim was to explore the characteristics of MCS in STP. I conceptualize a MCS as a package of controls, and, through the case study of UPTEC – the STP of the University of Porto, Portugal – I explored the configuration of such a package in this type of setting, and the factors that explain this configuration. In so doing, I developed a model of MCS in the context of STP.

This dissertation is organized as follows: after the present introduction, a comprehensive literature review is conducted in chapter 2, including a discussion of the main theories and models of MCS as a package, and of the nature and configuration of STP. On the basis of the literature, a basic model, or theoretical framework, of MCS in STP is presented. Chapter 3 tackles methodological aspects of this dissertation. In chapter 4 UPTEC case study is described and analysed. Finally, chapter 5 wraps-up the dissertation, presenting its main conclusions, limitations and suggestions for further research.

Chapter 2 - Literature review:

In this chapter main concepts of the dissertation will be reviewed. The management control systems will be defined as well as their role within organizations. I will examine the formal structure of the control systems and what lies behind formality, as well. Moreover, I will analyze informal roles and the dominant culture in the control systems. The problems facing managerial controls will be defined, too. And finally their role in STPs will be described. The used literature can be divided into three parts: the first part is about Management control systems as a package. The second part is about science and technology parks. The last part is about management control systems in science and technology parks.

2.1 Management control systems as a package:

A package of control comprises a complete set of MC practices, so it's the mirror of the organization's control environment. It might be a set of MC systems and/or a set of independent MC practices addressing unrelated control problems (Grabner & Moers, 2013). Several authors argue that the main problem in getting any system forward is the lack of "internal consistency". Internal consistency means that the interdependency of the value of one MC practice depends on the use of another MC practice, and vice versa. So, one cannot understand each MC practice separately, and to clearly understand a control problem, one should study the entire control environment of the organization.

According to the definition of Malmi and Brown (2008) Different systems are often introduced by different interest groups at different times, so the controls in their entirety should not be defined holistically as a single system, but instead as a package of systems. The authors here also emphasize the importance of studying the control systems as a package.

There is a difficulty for corporate management to create a control system in a multi business company which exploits the capabilities of all business units without contradiction to market place and corporate strategy (Nilsson & Olve, 2001) as a result they proposed three models of the control management: the model for performance, the model for value based management and the model for strategic management. They suppose that the distinction and

detailed description of these control models should facilitate decision making in the design and implementation of control systems in multi-business organizations. They conclude the solutions in appropriate models, knowledge, strategic dialogues and communication among different business units and finally strong infrastructure for information systems.

The control system of a lean manufacturing strategic initiative was investigated in the study of Kennedy and Widener (2008) . Lean controls review the performance of measurement and also concentrate on behavioral and social controls. They conclude that lean manufacturing affects both the accounting practices and control components. Besides that, they summed up that accounting practices are intervening the variable in the relationship between the control components and the lean manufacturing. Furthermore, they identified the bidirectional and unidirectional between management controls portfolio.

The start-up and interim phases of a collaborative alliance with five partners in the construction industry were studied by Langfield-Smith (2008) , examining how the partners' perceptions of trust impacted on the control package design. He concluded that governance structures and the components of MCS need to be complemented by trust in order to be able to manage this highly uncertain setting. The cultural controls are an important aspect of an MCS package in a collaborative setting.

The idea of lateral relations between and within organizations in order to develop a framework for designing control mechanisms in such contexts were examined by van der Meer-Kooistra and Scapens (2008). They found that the package of governance practices, underpinned by the social, technical, institutional and economic structures, provided 'firmness' in the relationship, while still allowing for 'flexibility' in coping with the changing and uncertain context.

MCS package in a growth firm was examined by Sandelin (2008), who inspected two different MCS packages in the face of similar contingent factors : Two MCS packages may possess this equifinality, their functionality seems to depend on internal consistency between

elements. Therefore, two packages may have contrasting elements, yet do the same job, as a result of internal consistency between the chosen elements in each of the packages.

The way in which each of the authors (Kennedy & Widener, 2008; Langfield-Smith, 2008; Sandelin, 2008; van der Meer-Kooistra & Scapens, 2008) conceptualized the MCS package in their studies was quite different, which means that trying to establish a coherent set of findings is a challenge. There is no consistent typology of the MCS package which would enable us to compare these configurations across the four papers and compare the influences on these configurations so that they can begin building a more coherent theory. Moreover, it is a challenge to study a MCS package empirically as they are often very large and complex systems. So the management control models for (Ferreira & Otley, 2009; Malmi & Brown, 2008) will be presented.

Malmi and Brown (2008) discussed the conclusions of these articles (Kennedy & Widener, 2008; Langfield-Smith, 2008; Sandelin, 2008; van der Meer-Kooistra & Scapens, 2008) and concluded by introducing a new MCS package conceptual framework: Planning controls, Cybernetic controls Reward and compensation controls Administrative controls Cultural controls. And they proposed the MCS package in figure (1). The components of MCS package are discussed here.

<table>
<tr><td colspan="8">Cultural Controls</td></tr>
<tr><td colspan="2">Clans</td><td colspan="3">Values</td><td colspan="2">Symbols</td><td rowspan="2"></td></tr>
<tr><td colspan="2">Planning</td><td colspan="4">Cybernetic Controls</td><td rowspan="2">Reward and Compensation</td></tr>
<tr><td>Long range planning</td><td>Action planning</td><td>Budgets</td><td>Financial Measurement Systems</td><td>Non Financial Measurement Systems</td><td>Hybrid Measurement Systems</td></tr>
<tr><td colspan="8">Administrative Controls</td></tr>
<tr><td colspan="2">Governance Structure</td><td colspan="3">Organisation Structure</td><td colspan="3">Policies and Procedures</td></tr>
</table>

Figure 1: Typology of Management control systems as a package Malmi & Brown 2008

The typology in Fig 1 Cultural controls is situated at the top in order to show that they are wide, but unclear controls. They are thought to be easy to change. Planning, cybernetic, and reward and compensation controls can be found in the middle of the typology. These are thought to be firmly connected to numerous contemporary associations, and are displayed in a temporal order from the left to the right. At the base of the typology are administrative controls which create the structure for planning, cybernetic, and rewards and compensation control.

Planning controls: Planning sets out goals for the functional areas of the organization, so we can say that it directs behavior and effort. Secondly, it provides standards to be achieved in relation to the goals, and clarifies the level of effort and behavior expected from individuals of an organization. Moreover, planning can enable coordination through aligning a set of goals across the functional areas of an organization, as well as controlling the activities of individuals and groups to ensure they are in line with the desired outcomes of the organization. In relation to planning, there are two broad approaches. The first is action planning, in which the goals and actions are set for the immediate future, usually a year. This has a more tactical focus. The second broad approach is long-range planning, in which goals and actions for the medium and long run are established. This has a more strategic focus. As planning has a major role in directing employees' behavior, it's treated as a separate system in this MCS typology. It is very important to understand whether planning is done for deciding on the future activities or whether the process involves building employees' commitment to these plans.

Cybernetic controls: A cybernetic system may be decision-support system and an information system. If managers themselves detect unwanted variances, they can modify their underlying activity or behavior. There are four basic cybernetic systems that have been identified in MCS research: budgets, financial measures, non-financial measures, and finally hybrids that contain both financial and non-financial measures—e. g., The Balanced Scorecard.

Reward and compensation controls: Reward and compensation systems focus on increasing and motivating the performance of groups and individuals within organizations by achieving

congruence between their goals and activities and those of the organization (Bonner & Sprinkle, 2002).

Administrative controls: Administrative controls, direct employees' behavior through organizing groups and individuals, monitoring behavior and employees, at the top of that this process is responsible for specifying how behaviors or tasks should or should not be performed. The typology considers three groups of administrative controls; organization design and structure, governance structures within the firm, and the procedures and policies. Organizational design is a very important control system, because it uses a particular structural type in which an organization can adopt certain types of relationships and contacts. The governance structure relates to the company's board composition and structure, besides its various management and project teams. Governance includes the formal lines of accountability and authority. Besides the systems which are in place to ensure that representatives of the various organizational units and functions meet for coordinating their activities both horizontally and vertically. Meetings and meeting schedules, for example, create agendas and deadlines which direct the behaviors' individuals. Finally Policies and procedures include: such approaches as standard operating procedures, practices, rules and policies.

Cultural controls: are the set of social norms, values and beliefs which tend to be shared by its members and, in turn, influence their thoughts and actions (Flamholtz et al., 1985).

The typology begins with the thought that control is about management which needs to guarantee the behavior of their workers (or any relevant party, for example, collaborating organization). All control systems should be in harmony with the firm's goals and strategy. In order to achieve this, the organization needs to be in charge of control and its division. The organization needs to comprehensively map the instruments and frameworks so that managers in practice can direct behavior both formally and causally. Taking into consideration that the managers have to coordinate behavior, the typology contains

advancement in the MCS configuration. This configuration includes types of control that have less consideration of old researches, for example, social & cultural controls.

In addition to that, this typology includes the different types of controls accessible to administrators, for example, administrative controls. Besides that, the typology incorporates the organizational structure. A lot of researchers have treated this as a contingent variable, however, it is considered to be a control mechanism here; as it can be used and modified by managers in the control process.

MCS typology can't be excessively narrow as there is a risk that some controls may go unnoticed and existing connections to different controls may affect the research results. Although, the typology needs to be parsimonious enough to make limits for an empirical research (Malmi & Brown, 2008).

The second model is proposed by Ferreira and Otley (2009) . They considered the model of Malmi and Brown (2008). The model gives a broad view of the performance management systems. It's showed in the figure (2)

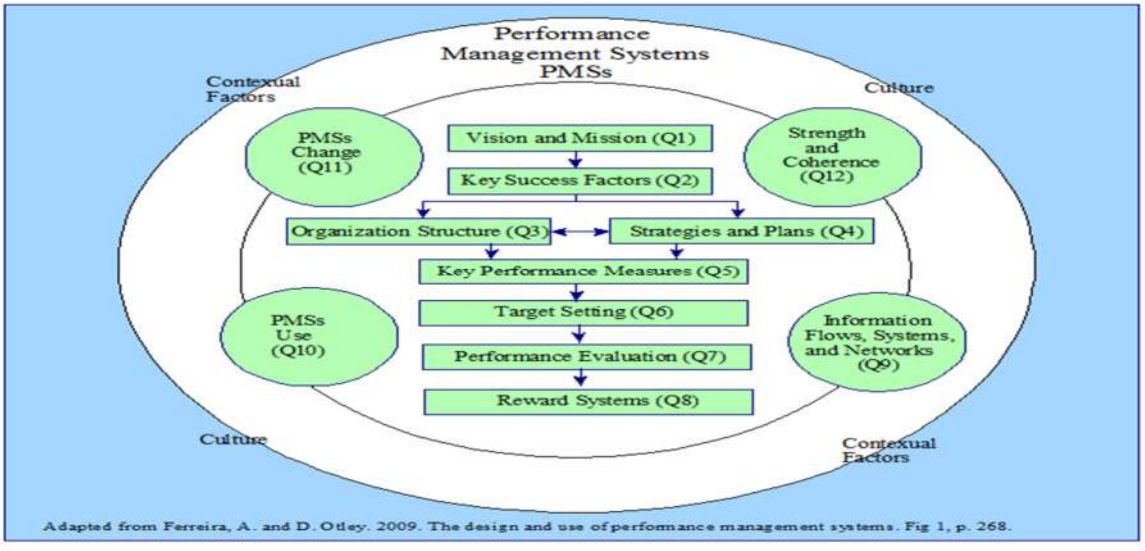

Figure 2 Theoretical model of PMSs Ferreira and Otley (2009)

1) The model starts with the vision and mission of the organization: The vision and mission statements are very important to both shareholders and stakeholders. Do managers and employees pay attention to the vision and mission of the organization? What processes, mechanisms and networks are used to move the organization's overarching purposes and objectives to its members?

2) Key success factors: what are these factors and how to make managers and employees pay attention to these factors? The key success factors (KSFs) are those attributes, activities, capabilities and competencies, that are considered as critical pre-requisites for the success of the organization in its industry or sector at a certain time (Thompson, Gamble, & Strickland, 2004)

3) Organization Structure: What's the organization structure? What's the effect of the organization structure of the performance management of the organization? Organizational structure is clearly a central control element, which has become the tool responsible for the change and improvement. Significantly, a lot of control systems work horizontally not vertically. And they aren't measured financially. However, the literature focuses on the vertical view of control, rather than controls through chains or processes.

4) Strategies & plans: What's the organization current situation? What does the organization stand for? And what does the organization want to do? These questions also draw out the nature of strategic management process by asking how strategies and plans are generated and communicated between managers and employees. The process may follow the traditional top-down approach where top managers undertake the strategic thinking, decision-making, planning, and then deliver it to the wider organization or it may follow a bottom-up approach where there is participation of all levels of management in the strategic process. Empowerment becomes very important with the rise of the 'lean', 'delayed', horizontal organizations, in place of vertical and hierarchical organizations (Otley, 1994)

5) Key performance measures: What are the organization's *key performance measures* deriving from its key success factors, objectives plans and strategies? How are these communicated and specified and what's their role in performance evaluation?

6) Key performance measures are the nonfinancial or financial measures (metrics) used at different levels in organizations to evaluate success in achieving their plans, objectives and strategies. Therefore, they are in charge of satisfying the expectations of different stakeholders. They are identified in the PMSs framework to reflect both the importance that relates to the performance measures in most organizations and the influence that such measures have on individuals´ behavior.

7) Target setting:

What level of performance does the organization need to achieve for each of its key performance measures? How does it go about setting the appropriate performance targets for them, and how challenging are those performance targets? Target setting is a critical aspect of the performance management .It's not a surprise that it is used for setting as well as rewarding and evaluating performance.

8) Performance evaluation:

What processes, if any, does the organization follow for evaluating groups, individuals and organizational performance? Is the evaluation of performance primarily subjective or objective, or mixed and how important are informal and formal controls and information on these processes? The area of the performance evaluation represents a critical relationship in control activities. Both the informal performance evaluation activities and the formal indicators should be covered. It is particularly important to distinguish between performance evaluation routines (often done by the human resources) and those actually operated by senior managers. As the employees' perception of the situation is even more important than the formal situation. Performance evaluations can be subjective or objective, or fall in-between these two extremes.

9) Reward systems:

What rewards are non-financial and/or financial? Will employees and managers gain by achieving performance targets or other assessed aspects of performance (or, conversely, what punishments will they suffer from failing to achieve goals). The rewards are typically the outcome of the evaluation of performance. The rewards are considered broadly here and can range from expressions of recognition and approval by senior management (or lack of criticism), through financial rewards (salary increases and bonuses) the promotion and long-term progression. The area of non-financial rewards is worthy of further preparation as it may often include quite subtle attitudes and behaviors of superiors. Thus, informal criticism or praise and general attitudes about an employee's progress within the organization can significantly influence the employees' behavior and thus the workings of the PMSs. Issues of fairness, equity and inclusiveness between different managers also loom large in many organizations.

10) Information flows, systems and networks:

Information systems, flows and networks are essential enabling mechanisms to any type of the performance management system. They are the binding tool that keeps the whole system together. They are like the nervous system in the body, transmitting information from the center to the extremities and from the extremities to the center. The undertaking of corrective and/or adaptive courses of action could be taken. Information systems enable the organization to learn from its experience, to generate new ideas and to recreate plans and strategies. How control information and performance is structured is an issue to be considered. Organizations are moving towards wider PMSs, such as balanced scorecards. There are also a lot of additional issues to be considered that are related to the characteristics of the information flows in the PMSs. These include issues such as timeliness (i.e. speed of reporting and frequency), information scope (i.e. broad scope or narrow scope), integration (i.e. interactions between subunits and inter-relationships) and aggregation (i.e. by functional

areas and by period) (Chenhall & Morris, 1986).They also include issues such as selectivity, level of detail, orientation, and relevance.

11) PMSs use:

What type of use is made of information and of the various control mechanisms in place? How do controls and their uses differ at different hierarchical levels?

12) PMSs change :

How have the PMSs adapted in the light of the change dynamics of the organization and its environment? Have the changes in PMSs use or design been made in a reactive or proactive manner? PMSs need to change in order to sustain their usefulness and relevance. The idea of change in the PMSs applies to the management control techniques and the performance measures used and the way performance management information is used .However, the issue is not the process of change itself, but rather the extent and type of change that has taken place in the PMSs design. It is very important to consider the scope of strategic change in the increasingly competitive environment faced by contemporary organizations.

13) Strength and coherence:

How coherent and strong are the links between the components of PMSs and the ways in which they are used? Like any other systems, a PMS is greater than the sum of its parts and there is a need for coordination and alignment between the different components for the whole to deliver effective and efficient outcomes (Ferreira, 2002).

Although Ferreira and Otley believe their PMSs framework provides an improved tool, they recognize that empirical evidence from case study research is needed to validate its adequacy. They also discussed some criticisms of their framework, and point out again that culture and contextual factors are not explored in the PMSs framework because these factors are outside the control of the organization. Managerial influence on organizational culture is controversial, but it might be an appropriate part of a broader framework. The performance management systems framework is based on inductive reasoning applied to various studies. It represents a powerful research tool for examining the structure of an organization's PMSs in a holistic manner

2.2 Science and Technology parks (STPs)

The first science and technology park was innovated at the Stanford University campus more than 60 years ago. It has transformed the Silicon Valley area from one of the poorest regions in the United States into a global center of education, research, technology and finance.

The definition adopted by the International Association of Science Parks and areas of innovation (IASP) is as follows: "A Science Park is an organization managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. To enable these goals to be met, a Science Park: stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities".

According to the definition of ISAP. There are five key characteristics of STPs (Claire Nauwelaers, Kleibrink, & Stancova, 2014):

1. The economic development goal at the local level.

2. The focus on strengthening the links between science-industry relationships.

3. A priority placed on technology and innovative based activities.

4. The action of providing value-added services to companies.

5. A property-based initiative.

Science and technology parks (STPs) try to facilitate networking among their tenants by (1) creating an appropriate ecology for cooperation through the selection of tenants and (2) by encouraging the formation of ties between these organizations through introductions and events. It has been found out that manager intervention as well as ecological characteristics have some effect on the prevalence of inter-organizations relationships. Tenants, whose

managers have a greater presence at the park have more equipment-sharing ties, and attendance at STP-organized events, which increases knowledge-sharing ties (Koçak & Can, 2014).

STPs congregate highly technological firms. The idea is that the closeness to other companies and opportunities for networking can make those firms more successful and innovative .STPs seek to imitate the success of naturally occurring clusters by generating economies of agglomeration: trading with each other, sharing resources, working on collective projects, and benefiting from knowledge spillovers. Encouraging the forming of ties among these firms through introductions and event (Kocak & Can, 2013) .

The model in Figure 3 provided by Oh and Kang (2009) illustrates the formal links with a university or other form of higher education and the research institutions, which can encourage the formation and growth of knowledge of the businesses . Management is usually responsible for transferring technology and business skills to the park. The science and technology parks usually create a value chain of the knowledge transfer. Transferring creative ideas into innovative products and then into industry. STPs usually have both regional and national objectives.

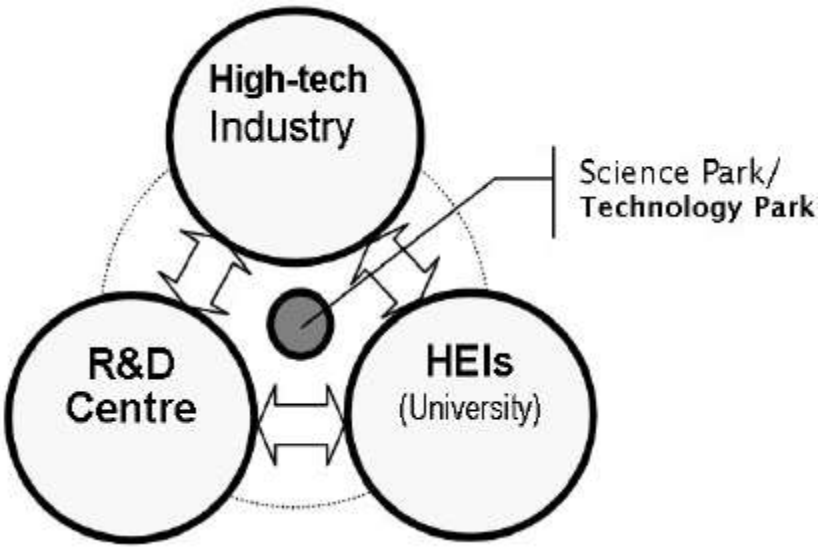

Figure 3: model the formal links of STPs (Oh & Kang, 2009)

There are two sides: the supply side (the Science Park), and the demand side (tenants of the Science Parks).The network includes the linkages – formal and informal – between the head of the Science Park to the tenants, but also the linkages established between tenants and between the Science Park and its environment (universities, research centers).

Science & Technology Parks : "are organizations managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture and diffusion of innovation and the competitiveness of its associated businesses and knowledge-based institutions" (Gatt, 2010)

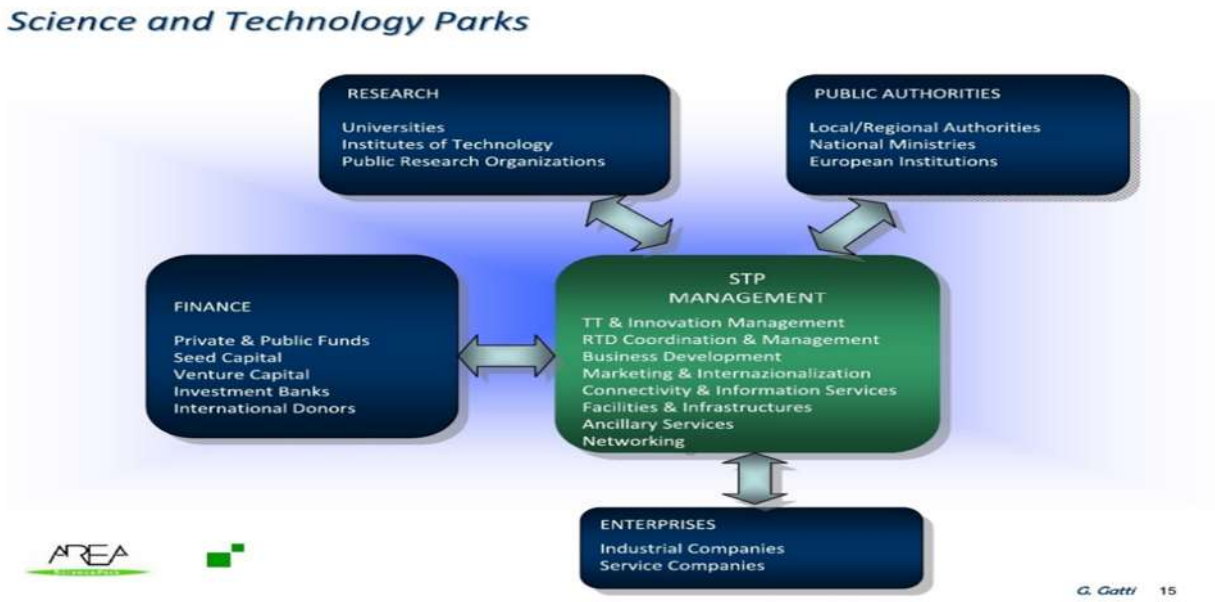

Figure 4 : STP networks (Gatt, 2010)

The above image describes the science and networks of science and technology parks and their relations. STP management has a lot of networks not only inside the STP, but also outside it. There are a lot of networks with stakeholders, too. Generally, the most important network, is the network with the research entities such as universities, institutes of technology, public and private research entities. Secondly, the enterprises like industrial and service companies. If STP has a business incubator, the startups will be very important, as well. Thirdly, the network with finance like banks, investors and donors. Finally, the network

with public authorities. Whether local, national or international authorities, it is crucial that STP has worldwide relations.

Science and Technology Parks (STP s) are exceptionally regular instruments utilized by local and national powers for the provincial advancement. Their principle target is to encourage science-based development posts to invigorate financial expansion far from declining commercial enterprises. Today, STPs are displayed in numerous European areas. They pool an extensive variety of creative organizations and research associations, and as an outcome knowledge intensity of these spots are high. STPs are, therefore, liable to incorporate seeds for the areas domains of knowledge-intensive specialization, on which regions can depend to build their competitiveness. This is the reason STPs appear to be decently set to play a key part in development systems for smart specialization (Claire Nauwelaers et al., 2014).

The given model in fig 5 was suggested by the UNESCO report, which describes the science parks in Egypt (Oh & Obe, 2007). It characterizes the potential flow of companies through a science and technology park and for which provision is required in the physical planning. This model gives full details of the science and technology parks. The description of STP in this model suits a lot UPTEC which is the case study of this dissertation.

The science park, according to the model has two types of companies:

- Incubated startups: there are three phases for incubated companies. The first phase is the pre-incubation. In the pre-incubation phase, there is a lot of preparation given to a company and its team. There are programs usually provided to companies. In these programs the experience regarding the market and networking with others, is given to the companies. The second phase is the phase of incubation in which the company is already accepted by the park and now it works in the park and can manage its matters independently. The third phase is the post-incubation. In this phase, the company has already succeeded in the park and has its image in the market and now this company has the freedom to continue in the park or can work outside the park. If a startup has companies succeeding in all three phases, the park will succeed, too. Because the primary role of the park is to encourage startups and lead them to success. Moreover, in the long-

run it can help increase the level of employment of the country and this way develop economics of the country.

- Big companies may be national or international. A big company normally wants to have a branch, lab, research center or office in the park in order to be able to communicate with startups and create new ideas. The main benefit of these companies is providing practical experience to startups and the networking with these startups.

The model also provides the frame of networking in STPs. The role of university and research institutions in the region is very important as they are the main sources of creating ideas and scientific experience which all companies in STP need. Besides that, networking within local and international businesses is important as they provide signs or indicators of technologies with the highest market growth.

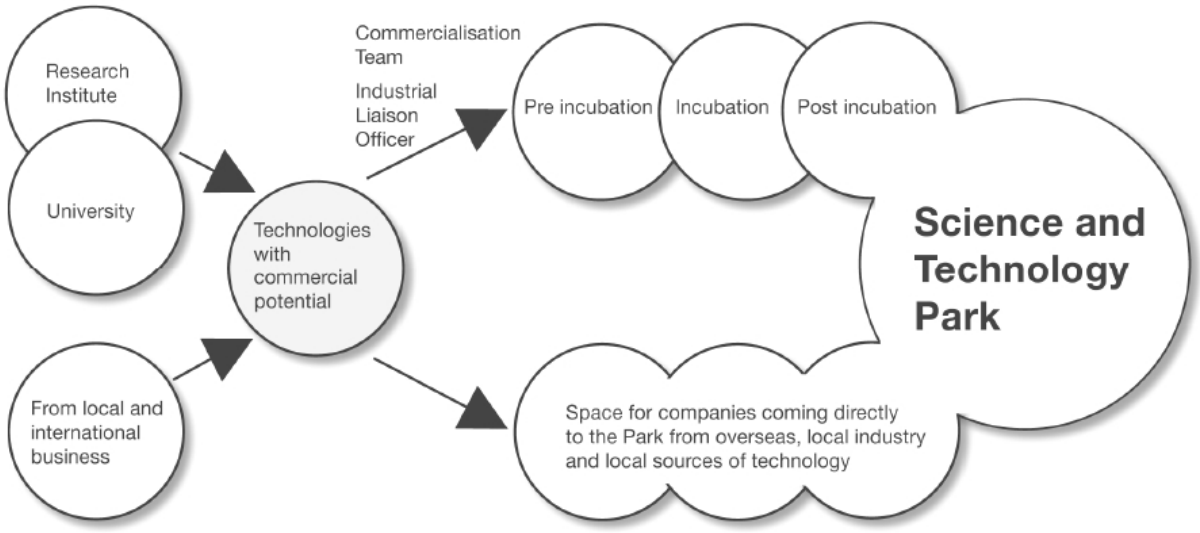

Figure 5: Description of STP (Oh & Obe, 2007).

2.3 Management Controls in Science & Technology Parks:

The literature lacks the theme of MCSs in science and technology parks, however, there are a few studies about the management control systems in multi-business organizations or management controls in the organization within the context of the network. The management of Science and Technology Park plays the role of the network coordinator and it manages a lot of functions. The management of Science Park manages a network of multiple relationships. This network may be inside or outside the science park. The network inside the park includes the incubated startups, big companies, and different research and innovation centers. The network outside the park includes the university, governmental authorities, other relationships with different research centers and organizations. The management of the Science Park has to manage all relations on both levels of formal and informal one. The network coordinator has a lot of functions which together aim to achieve the predetermined or desired level of network performance (Marques et al., 2011)

In the dissertation, different control systems with different networks of STP will be discussed and described. There are a lot of problems in managing networks of inter-organizational relationships, according to Dekker (2004). Firstly, the management of appropriation concerns the coordination of tasks. Secondly, the control mechanisms used to manage these control problems and their interrelationships with informal (trust-based) mechanisms. Thirdly, the barriers regarding horizontal or vertical communication and collaboration between different departments and actors. Finally, facilitation, strengthening and building synergies between enterprises, research centers, universities, intermediary organizations and public stakeholders.

Increasing the opportunities of the network formation among their tenants is possible to be done in two ways. Either by shaping the ecology of the tenant population that they admit into the park or through the direct interventions aimed at introducing tenants to one another (Chan & Pretorius, 2007).Tenants, whose managers have more presence in the park and attend at STP-organized events, increase the knowledge-sharing ties. STP managers' brokerage activities also help with the equipment sharing tie (Kocak & Can, 2013). STPs and their relations with tenants are affected by the level of heterogeneity (Duranton & Puga, 2004;

Kocak & Can, 2013) . Focal tenants will have more relationships with other tenants in the park if a greater proportion of the park tenants are of a different size than the focal tenant. Firms have more relationships if a greater proportion of firms in the STP are in the same industry. STP managers may play a role in strengthening the relationships, building trust, or improving the efficiency of the tenant networks. STPs invest in attempts to facilitate the formation of various kinds of inter-firm relationships, partly in response to the demand for such services from their tenants.

There are two control problems or gaps in managing STPs. These are configuration gaps and process gaps. The configuration gaps: include insufficient resources and inappropriate infrastructure. The process gaps: include negative attitude towards learning, cultural barriers of networking and misunderstanding concerning type of support provided (Albahari, Klofsten, & Canto, 2011). In the following table 2 the gaps of control problems in science and technology parks.

Configuration gaps :	Process gaps :
Inappropriate infrastructures	Cultural barrier to networking
Types of facilities not allowed	Aptitude about learning
Excessive distance from universities and research centers	Too theoretical support
Unavailability of venture capital	Pedagogical issues
Lack of business expertise	Lack of information
Budget restrictions	Non-customized support
	Lack of interest/motivation and time restrictions

Table 1: Management control Gaps in STPs (Albahari et al., 2011)

Configuration gaps are those related to the static configuration of the Science Park. These sorts of gaps are ordinarily created and overcome during the planning phases of the Science Park and include: - Inappropriate infrastructures, in terms of adaptability, accessibility of spaces and offices.

Process gaps are those identified with the dynamic activity when Science Park provides services to their inhabitants. These may include:

- Entrepreneurs' social barriers to systems administration and to experience sharing.
- Entrepreneurs' inclination about learning.
- The support received as being excessively hypothetical and a long way from firms' regular needs.
- Non-customized support on firms and on firm’s phase of advancement.
- Lack of time to go to meetings; entrepreneurs and administrators are occupied and over-loaded with work and could see the activities offered by the Science Park as a wasting time.
- Lack of inspiration or interest.

2.4 The proposed model of management controls in the Science and Technology Parks in the light of literature:

I could not find a model of management control systems in science and technology parks. In this section I seek to fill this gap by proposing a management control model for STPs. This model is proposed in light of the literature on 'packages of controls' discussed in previous sections (Ferreira & Otley, 2009; Malmi & Brown, 2008). Also relevant was the literature describing aspects and configurations of science and technology parks (Claire Nauwelaers et al., 2014; Gatt, 2010; Kocak & Can, 2013; Koçak & Can, 2014; Oh & Kang, 2009; Oh & Obe, 2007). Finally, I also drew inspiration on literature on management controls within networks (Dekker, 2004; Marques et al., 2011), and on literature on management control gaps within organizations of networks (Albahari et al., 2011; Chan & Pretorius, 2007; Duranton & Puga, 2004; Kocak & Can, 2013). So, based on the literature reviewed, I am trying to propose a new MCS model that is applicable to STPs, and I will seek to apply it to UPTEC. The proposed model takes the shape of a pyramid in figure 6.

Figure 6 New model of Management Control Systems for STPs

1) The Vision and Mission of STPs:

Vision and mission are placed at the basis of the model. The vision is an aspirational description of what an organization would like to accomplish in long-term future. It is intended to serve as a clear guide for choosing current and future courses of actions. While the mission is a declaration of an organization's core purpose and focus that normally remains unchanged over certain time.

Ferreira and Otley (2009) consider the vision and mission of the organization as managerial controls as they give information about how organizational purposes and values are communicated and established as the means of influencing the behavior of organizational participants. The vision and mission affect the behavior of managers at all levels.

The vision and mission of any STPs are different from any other organizations. Achieving high growth profits may not be one of the goals of the STP. STPs have a lot of social responsibilities to achieve. The STP´s vision is to foster the creation of technology-based companies and capture national and international tenants. The mission of STPs should not only accept highly potential growth projects, but also create new jobs, add contribution to the national economic development and keep their social responsibilities.

2) Organizational design and structure:

The organizational structure is considered as a form of managerial control which works through functional specialization and the design of a company affect different controls that can be applied (Flamholtz, 1983; Malmi & Brown, 2008). Albahari et al. (2011) considered the inappropriate infrastructure as a configuration gap that affects negatively the control systems in STPs. The design of the infrastructure of STP affects the use and success of different managerial controls. Consequently, the infrastructure of STP should consider control systems that are supposed to be applied. And the design of infrastructure that suits the desired control systems should be clear from the early planning stage for STP.

3) Cultural controls:

Cultural controls are situated at the top of the typology of Malmi and Brown (2008). They are considered to be one of the most important managerial controls in any organization. Also Albahari et al. (2011) support this point of view in Science and Technology Parks and consider the cultural barrier as the first process gap in their model . As in STPs there are a lot of people who work together, they are often from different backgrounds and specializations and may be sometimes from different countries. Consequently, there is a fusion of different cultures that might complicate networking between people in STPs. Culture plays an important role in STPs as in this type of innovative organizations we mainly deal with new ideas and processes. For this reason, the relationships should go smoothly and easily among people and informal relationships should be strengthened at all levels. Bureaucracy, routines, restrictive formal relationships should be discarded. Managers should do their best to strengthen the trusted relationships among people inside STPs, moreover, they should build trusted relationships outside STPs with universities, researchers, markets, as well.

4) Strategies and plans:

Strategy, long term planning, and action planning are managerial controls (Ferreira & Otley, 2009; Malmi & Brown, 2008). In STPs, action plans and strategies should take into consideration the opportunities of network formation among their tenants in two ways. Firstly, by shaping the ecology of the tenant population that they admit into the park and secondly, through the direct interventions aimed at introducing tenants to one another (Chan & Pretorius, 2007).

5) Information flows and networks:

Information flows and networks are essential enabling mechanisms in any management control system. They are the binding tool that keeps the whole system together. They are like the nervous system in the body (Ferreira & Otley, 2009). Furthermore, according to Dekker (2004) the barriers regarding horizontal or vertical communication and collaboration between

different departments and actors are one of the most obvious control problems in managing networks of inter-organizational relationships. Albahari et al. (2011) considered the problem of lack of information as a process gap. The network coordinator of Science and Technology Park must facilitate, strengthen, build synergies and networking between startups, research centers, universities, intermediary organizations and public stakeholders.

6) Key success factors:

In Ferreira and Otley (2009) model key success factors are considered to be one of managerial controls . The key success factors (KSFs) are those attributes, activities, capabilities and competencies, that are considered as critical pre-requisites for the success of the organization in its industry or sector at a certain time (Thompson et al., 2004). Also STPs may have different KSFs like networking with university, different funding options like loans, national or international support, and the most important one is the criteria used to select incubated startups.

7) Performance Evaluation:

For the organization within networks the network coordinator has a lot of functions which together aim to achieve the predetermined or desired level of network performance (Marques et al., 2011). Budgets, financial measurement systems and non-financial measures are managerial controls for any type of organization according to (Ferreira & Otley, 2009; Malmi & Brown, 2008). According to Albahari et al. (2011) budget restrictions could cause a control gap in Science and Technology Parks . But STPs aren't that type of organization aimed at profits. Usually STPs are owned by a state or university and have a big role in the society. Their role is to measure the performance according to social responsibility. Returning to the definition of International Association of Science Parks and Areas of Innovation and (Claire Nauwelaers et al., 2014) , the STPs contribute to economic development , strengthen the links between science-industry relationships , foster innovative ideas and take the action of providing value-added services to companies. Hence, we can evaluate the performance of STPs according to 1) Number of startups & big companies. 2)

Global and national awards. 3) Occupation ratios for startups and big companies. 4) Returns 5) Contribution to the economic development of the country.

8) Formality and coherence:

The role of the framework is to help a 'snapshot' to be taken of the package of practices that are in operation at a particular point in time, and to gain some sense of how these practices have evolved into their current form. As such, it is believed that it can serve as a useful research tool to enable such practices to be documented and correlated with other (Ferreira & Otley, 2009)

Coherence and strength of the links within MCS are critical for understanding all control operation. Although, the individual components of the MCS may be apparently well-designed, evidence suggests that when they do not fit well together (either in use or design) control failures may occur (Ferreira & Otley, 2009; Ferreira, 2002).The MCS of STP should exist and be applied in a formal way. It's not enough to have only some managerial controls. But the overall management control system should be in a formal shape.

The Key Features of the Proposed Model of MCSs in STPs is shown in the table 2.

Dimensions of MCS	Key distinguished Features in STPs
Vision and Mission	Vision is the contribution to the national economic development and fostering of the creation of technology-based companies Profits, shareholder value aren't the key mission,
Organizational design and structure	The design of the infrastructure should suit the desired control systems
Culture Controls	Multiple cultures, high culture barrier
Strategies and plans	Taking the opportunities of networking formation among tenants
Information flows and networks	The horizontal or vertical communication and collaboration between different companies should be enhanced
Key success factors	1) The criteria used to select incubated startups 2) funding options, 3) networking with university
Performance Evaluation	1) Number of startups & big companies. 2) Global and national awards 3) Occupation ratios for startups and big companies. 4) Returns. 5) Contribution to the economic development of the country.
Formality and coherence	• The MCS of STP should be existed and applied in a formal way. • MCSs should fit together

Table 2: The Key Features of the Proposed Model

Chapter 3 - Methodological Aspects:

The main goal of the study is the description of MCSs in STPs as an example of an organization within networks. A new model of MCSs has been proposed in section 1.4.

Qualitative methods are truly helpful in developing or creating hypotheses or reasonable structures or, to put it an alternate route, in producing theories. These techniques can likewise be utilized as a part of refining hypotheses and theories through testing (Sofaer, 1999).

AS in-depth analysis, the phenomena will be examined, including aspects beyond formal rules and instructions: thus, case study analysis will be used. After applying and describing different components of the model in the case study. A matrix of founded gaps and proposed solutions will be presented.

The case study is UPTEC, the Science and Technology Park of Porto University. The sources of data will be through semi-structured interviews, structured observations of events and interactions, collection of relevant documents and content analysis.

While applying the new model on the UPTEC. The gathered documents and observations are compared with the interviewees' explanations. Three open-ended interviews with the management team in UPTEC are going to be used together as well as the different informal discussions with different employees in companies inside UPTEC which were conducted between December 2014 and April, 2015. One comprehensive seminar, which was given by one of the board members of UPTEC in December 2014, is going to be used, too.

A complete list of the plan of the interviews together with the questions are shown in Annex. The used questions are open-ended. Some key issues are discussed in the research through documents and / or interviews:

- Specification in detail of the network of UPTEC (formal and informal).
- Identification of barriers to horizontal or vertical communication and collaboration between different departments and actors.
- Discussion 'configuration and process gaps' (see table above).
- Check whether the 'optimal level of heterogeneity' is an issue at stake in the organization and, if so, what are the concerns /mechanisms deployed in order to ensure that this optimal level is attained?
- Examination of the deployed formal management control mechanisms, and their interrelationships with informal (trust-based) mechanisms?
- Identification of the (formal and informal) means used to facilitate, strengthen or build relationships and synergies between enterprises, research centers, universities, intermediary organizations and public stakeholders.
- Inspection of a formal structure of cooperation between faculties like FEP, FEUP and Research Centers in Universities to strengthen the relationships (or is it all informal)?

Chapter 4 - Case Study Analysis:

UPTEC is the Science and Technology Park of Porto University. UPTEC aims to support the transfer of knowledge and technology from the University of Porto to the market. In essence, the UPTEC focuses on offering the shared resources and services, according to a strategy of clustering.

UPTEC thus aims to be an important network of science, knowledge and technological innovation, with a strong presence in the Northern Portugal, particularly in Porto, a city that has played an important role in the development of science and knowledge.

Firstly, we have the management of UPTEC which consists of a president and director. Then there are departments, namely: 1) Networks and Informatics, 2) Image and Communication, 3) Financial, 4) Legal, 5) Built Management, 6) Maintenance, and Logistics and Quality.

UPTEC has four centers which are: 1) Creative Industries Center (PINC), 2) Technology center, 3) Biotechnology center and finally 4) sea center. Each center has incubated startups and innovation centers. The innovation centers are completely different from the incubated startups as in the Center for Business Innovation, the existing businesses find the space and mechanisms to host and operate their projects and activities, benefiting from the synergies that exist with the R&D Departments and other interface institutes of the university. For example, Microsoft has an innovation center in UPTEC.

1) Creative Industries Center:

UPTEC PINC is the attraction and a meeting place for people who look for experience and want to explore and develop their creativity in entrepreneurial ways. Seeking to answer the new challenges of the creative economy, in 2010, UPTEC opened its Creative Industries Centre (UPTEC PINC) to accommodate and support companies that work primarily in areas such as design, audiovisual, communication, architecture, visual arts, performing arts and publishing.

Located in the city center of Porto among the main artistic and cultural structures and equipment in the city, UPTEC PINC currently hosts more than 30 creative business projects. Relying on the knowledge and expertise of the University of Porto and the other UPTEC clusters, this center really contributes to the development of truly creative ecosystem, in permanent liaison with the most diverse areas of knowledge and business.

2) Technology center:

The Technology Center of the Science and Technology Park of University of Porto (UPTEC TECH) provides support, infrastructure and technological equipment that enhances the development and acceleration of technology-based projects.

Currently, UPTEC TECH hosts over 60 startups and innovation centers in a wide range of technological areas of expertise, including: energy, web and mobile software, electronics, robotics, chemistry, polymers and composite materials, monitoring, etc…The center provides support for national and international companies focused on the development of innovative and market-oriented products and services, supported by knowledge and technology transfer and an active incorporation of highly qualified and skilled talent from the University of Porto. UPTEC TECH - the first and largest center of UPTEC - is located in the middle of Asprela's Campus, next to the most important technological schools and R&D institutes of the University of Porto.

3) Biotechnology Center:

The Biotechnology Center of the Park of Science and Technology of University of Porto (UPTEC BIO) is oriented to host business projects in the areas of life sciences and biotechnology.

UPTEC BIO offers a range of equipment and technological infrastructure that promote the development and acceleration of the installed projects based on the knowledge and skills

generated within the University of Porto, and also resulting from the cooperation between the university and the market.

At present, UPTEC BIO supports startups in a wide range of areas of expertise, including biotechnology, pharmaceutical and cosmetic industries, health care, chemistry, agri-food industry, etc. Like the other UPTEC centers, the location of UPTEC BIO takes a decisive role. This center is located near some of the most relevant schools and R&D institutes of the University of Porto in the areas of life sciences and biotechnology.

4) Sea Center:

The Sea Center of the Science and Technology Park of the University of Porto (UPTEC MAR) is dedicated to the incubation of business projects related to science and sea technologies, benefiting from the proximity of structures and equipment of the Leixões Port and advanced research developed at the University of Porto.

The project UPTEC MAR aims to explore the results of research arising from the activity of the various R&D centers from the University of Porto.

Companies currently associated with UPTEC MAR aggregate several areas of activity in the sea economy, such as marine biotechnology, aquaculture, and energy of waves, marine robotics, software, environment, tourism and recreational boating

4.1 MCSs in UPTEC in the light of new model of Management Control Systems for STPs:

1) The vision and mission of UPTEC:

The vision and mission of UPTEC are completely different from any other profitable organization. The vision and mission of UPTEC are derived from its social responsibility toward Portugal. UPTEC doesn't seek for purely financial profits.

The UPTEC's vision is to be, in the future, a Science and Technology Park of reference, not only at the national level, but also in an international context, capable of driving change, foster innovation, and contribute to the development of the economy. Its mission is to be a world class STP, which drives change and reinvents the Portuguese economy. Its goal is to generate 350 new companies together with 5000 new jobs in 2020.

The success of STP isn´t measured only by profits as the vision and mission of any STPs are different from any other organizations. The vision and mission of UPTEC mainly concentrate on the contribution of the economic development of Portugal.

2) **UPTEC Design & Structure**:

Divided into four distinct areas – Technology Center, Creative Industries Center, Sea Technology Center and Biotechnology Center.

UPTEC includes two types of the support structures for businesses, including the Incubators and the Centers for Business Innovation.

In the Incubator, entrepreneurs find the necessary support to turn their ideas into businesses with the potential for the rapid growth.

At the Center for Business Innovation, the existing businesses "usually big companies" find the space and mechanisms to host and operate their projects and activities, benefiting from the synergies that exist with the R&D Departments and other interface institutes of the University of Porto.

The organizational structure is considered as a form of the managerial control (Flamholtz, 1983; Malmi & Brown, 2008). Albahari et al. (2011) considered the inappropriate infrastructure as a configuration gap that affects the control systems in STPs negatively.

Although, the new building of UPTEC provides a lot of facilities, spaces and centralized management, it has very restricted, small spaces and glass roams for tenants. As some tenants want more space they remove a wall if it is possible. What is more, the new building follows a lot of formality rules, however, this isn't suitable for such an innovative organization. The building should consider managerial controls in its design, but now the most applicable solution is the adaptation to the new building.

UPTEC depends a lot on the infrastructure of the university in terms of reducing costs for instance. Yet, the existence of the biotechnology center in the faculty of science puts some restrictions on the center. In addition to that, the UPTEC shares security with the university which results in a condition in which managers don't have a full authority to deal with security. Although, the funding isn't a problem right decisions should be quicker. Additionally, UPTEC should be independent from the university.

3) Cultural controls :

In UPTEC Cultural barriers are very likely to be found. Different people with different specializations from different companies work under the roof of UPTEC and they have to network with each other.

Cultural controls are put at the top of the typology of Malmi and Brown (2008) and are seen as one of the most important managerial cont**r**ols in any organization. Also Albahari et al. (2011) support this point of view in STPs and consider the cultural barrier as the first process gap in their model.

On the contrary, there aren't any cultural barriers in UPTEC as most of people and teams are young people from Portugal. In this generation, it's rare to find cultural gaps or barriers.

UPTEC sometimes creates social events and in these cases, it's preferred to have all people from all centers and companies and not to separate them as the relationships are

interdisciplinary and each area may be important for other area. Managers facilitate relationships personally.

There isn't a culture barrier in communication between big companies and startups. The relationship between both types is guided by mangers. They don't have to organize special events to promote these relationships. The relationships are encouraged by managers at the personal level.

The cultural barrier does not exist in the relationship with foreigners in UPTEC, either. Managers in UPTEC see this as the consequence of the fact that the world is considered to be as a small village and there is a unified culture among the youth.

Even when UPTEC tries a new IT system, there isn't any resistance from companies to these changes, they are also open to learn a new IT system. As most teams are young, they like challenges and seek for advancements.

4) **Strategies & plans**:

Strategy, long term planning, and action planning are managerial controls (Ferreira & Otley, 2009; Malmi & Brown, 2008). In STPs, action plans and strategies should take into consideration the opportunities of network formation among their tenants (Chan & Pretorius, 2007).

UPTEC creates technology based companies and creative businesses and attracts the innovation centers. UPTEC brings together experienced big companies with startups in order for them to share their experiences and new ideas. Moreover, it supports the transfer of the effective knowledge and technology from the academia to the market. It's pursued through a clustering strategy and by sharing resources and services.

5) Information flow, systems and networks:

There are two types of networks inside UPTEC. The internal networks, which include main centers and their incubated companies and large companies. And the external networks, including the European Commission, which finances about 85% of UPTEC. Besides that , the university which finances about 15 % of UPTEC and the government authorities like

taxation systems, safety systems and finally the relationships with other research institutions outside the university and markets.

After analyzing the data and the deep study of different sources of the literature (Chan & Pretorius, 2007; Claire Nauwelaers et al., 2014; Gatti, 2010; Koçak & Can, 2014; Marques et al., 2011) I have decided to use the structure of UPTEC networking, which can be seen in the figure 7. As the image suggests, UPTEC consists of a lot of networks and the management team of UPTEC has a lot of functions to do. The management team plays the role of the network coordinator, which has a lot of functions. Their aim is to achieve the predetermined or desired level of network performance (Marques et al., 2011)

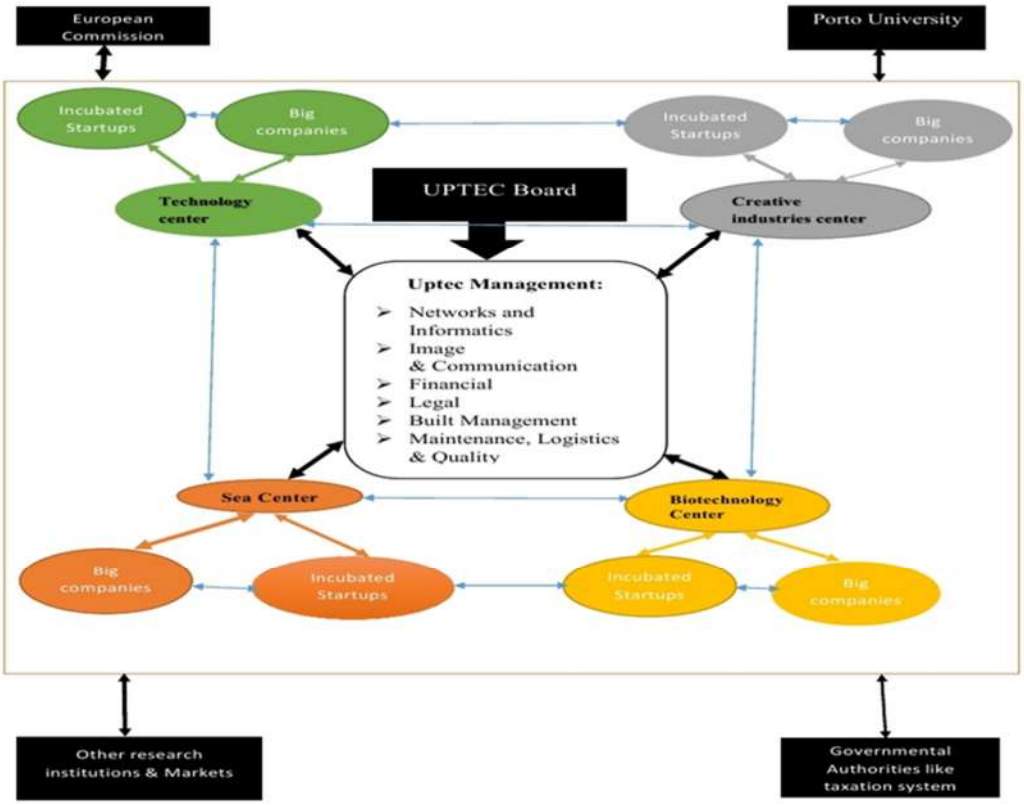

Figure 7 : The structure of UPTEC networking

UPTEC managers coordinate the internal networking relationships by informal ways. They strengthen the relationships between the incubated and big companies and facilitate the communication among them. All internal networking depends on the informality.

External networking relationships with the university management, the European commission and the governmental authorities are very formal and usually coordinated by the board of UPTEC.

However, on the operational level with university, networking relationships are very informal. People in UPTEC are gradually building experiences supervised by helpful professors or consultants in their faculties. They deal with their network and guide other people in their preferred areas at the university. Also, the informal relationships are away from the routines and arrogance of some professors.

It's reasonable for UPTEC to try to limit provided services like restaurants, bars, nursery, ATM machines, supermarket, post office, etc. in order to keep the control of the environment. Providing these types of services depends not only on external contracts through public announcements, but also on the conditions of health and safety. As the UPTEC´s main building and other research centers are in the heart of Porto city,

STPs and their relations with tenants are affected by the level of heterogeneity (Duranton & Puga, 2004; Kocak & Can, 2013). UPTEC can control the network and coordinate activities, if there is a high level of heterogeneity among tenants. On one hand, the high level of heterogeneity decreases the competition among tenants, on the other hand it strengthens the networking among them.

It is very important to consider the scope of strategic change in the increasingly competitive environment faced by the contemporary organizations. In UPTEC managerial controls changes are done in a reactive manner for i.e. UPTEC is working now for an intranet and centralized center for all information and contacts to facilitate communication among all parts of UPTEC

The managers face control problems of the information system as they work in two places in the main building and in the research centers. Since, the centralized information system does

not exist, this situation creates a lot of struggle. This problem can be solved through the intranet network that covers all UPTEC buildings and the centralized data center that enables managers to access all data and contacts.

6) Key success factors:

In Ferreira and Otley (2009) model key success factors are considered one of the managerial controls . The key success factors (KSFs) are those attributes, activities, capabilities and competencies that are considered as critical pre-requisites for the success of the organization. The UPTEC success factors are strong relationships and networking with university at all levels. The funding and support from the European Commission are considered one of strong success factors. The most substantial success factor in UPTEC is the criteria used to select incubated startups. The criteria depend on the idea of project & capability. For i.e. the quality, suitability of idea to UPTEC, and the capability of the team to execute the idea.

In UPTEC, there is a need to have more business experience. It may be through adding a consultant or highly experienced businessman on board. This man/ consultant should be aware of real market needs in Portugal and the Europe.

7) **Performance Evaluation**:

Budgets, financial measurement systems and non-financial measures are managerial controls for any type of the organization according to (Ferreira & Otley, 2009; Malmi & Brown, 2008). According to the definition of ISAP and (Claire Nauwelaers et al., 2014) the STPs contribute to the economic development , strengthen the links between science-industry relationships , foster innovative ideas and take the action of providing value-added services to companies

As stated in the proposed model, performance of STP can be measured by 1) Number of startups & big companies. 2) Global and national awards. 3) Occupation ratios for startups and big companies. 4) Returns. 5) Contribution to the economic development of the country. In table 3 different measures of the performance evaluation in UPTEC are presented.

Overall performance of UPTEC is very good. There is a balance between returns and expenses. The occupation ratio is very high. Although, UPTEC is considered a new STP. It has been awarded a region`s star which is a unique award from the European Commission. Also UPTEC provides a push for economic development in Portugal as shown in table 3.

Key performance measures	Evaluation
Number of companies, startups & big companies	Accumulated increasing in the Number of companies from 5 in 2007 to 165 in 2015
Awards	➢ Award of RegioStar : European award 2013 for smart growth because of connecting universities to regional growth ➢ "Trabalhamos para si": (we work for you) Portuguese award in 2014
Occupation ratios for startups and big companies.	It's 90% occupation of all available spaces in UPTEC except Sea center 20 % of the occupation as It's just started in March 2015
Returns	There is a balance between expenses and gains as UPTEC has a social responsibility role
Economic development	1,210 highly skilled jobs created till 2014, in 2011 it is estimated that revenues generated tax to the Portuguese State were approximately 79 thousand euros.

Table 3 : Performance Evaluation for UPTEC

8) Formality and coherence:

Distinction and detailed description of control models should facilitate decision making in the design and implementation of control systems in multi-business organizations (Nilsson & Olve, 2001). UPTEC already has some management controls and performance measures, but they aren't organized in a perfect formal framework. The coherence and strength of the links within the control system frame are very weak.

Although, the individual components of the MCS may be apparently well-designed, evidence suggests that when they do not fit well together (either in use or design) control failures may occur (Ferreira & Otley, 2009; Ferreira, 2002)

There aren´t formal management control systems or complete performance measures framework. We can conclude that even though UPTEC already has some control systems and performance measures, there is a need to have a complete framework.

Chapter 5 - CONCLUSIONS:

One first conclusion of this study concerns the nature of personal relationships and informality, a very important issue within science and technology parks. Based on the literature reviewed, I expected to find a lot of cultural barriers within the case organization studied – UPTEC – as it includes a lot of people working together, who come from different backgrounds and specializations and sometimes from different countries and languages. On the contrary, I found no significant cultural barriers in UPTEC. My interviewees justified this fact with the ideas that the world has become a 'small village', so there is a global culture and thinking. I also concluded that intranets and a center for information systems are of order in STPs. Furthermore, I found that the main control problem in managing the infrastructure is the dependency from the university to reduce costs. Hence, managers do not have a full authority, which in turn caused conflicts. I also found that the internal networking of an STP can be efficiently controlled if the level of heterogeneity among tenants (incubated startups) is very high. Indeed, the high level of heterogeneity among tenants implies that there is a low level of competition between them and that they can more easily cooperate together. Finally, I advanced a model of MCS in STP's, derived from the literature, which allowed me to make sense of UPTEC's case study. This is also an important contribution of this study.

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Limitation & Suggestion for further research:

This study of STPs provides an example of an organization within a network. The study provides a model of management control systems as package in STPs. However, I applied this model to only one organization: there is a need for more studies to test the model and provide more advancements and justifications for it. Further research can be conducted to test the relationship between MCSs and innovation processes. More studies can be done to present the MCSs in different types of organizations within networks.

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Annex

Annex A.1 form of the interviews

Plan of interviews with managers of different centers in UPTEC.

My interview will be on two levels. First one the uptec as a whole entity. Second one will be up on the center itself . I am going to discuss all managerial control problems in the networks relations within uptec.

After Greetings and thanks for her cooperation I will show her the table of configuration gaps and process gaps and I will going in details for explanations of any terms when it's needed

Configuration gaps :	Process gaps :
Inappropriate infrastructures	**Cultural barrier to networking**
Types of facilities not allowed	**Aptitude about learning**
Excessive distance from universities and research centers	**Too theoretical support**
Unavailability of venture capital	**Pedagogical issues**
Lack of business expertise	**Lack of information**
Budget restrictions	**Non-customized support**
	Lack of interest/motivation and time restrictions

Organization acts as a network coordinator

MCMs as instruments or processes which are deployed to influence the other network organizations to cooperate in achieving the desired or predetermined network performance

- Do you think there is any problems in terms of control mechanisms because of inappropriate infrastructures?

- So do you think the problem is completely solved with the new building?

- So what's your suggestion? Do you see working in old building and in new one double the work for managers and loss the control in all entity?

- But if all uptec centers, companies, management in one full building so it's better?
- Is there a formal structure of cooperation networking between faculties like FEP, FEUP and Research Centers in Universities to strength the networking relationships (or is it all informal)?

- Does Uptec provide main services for their tenants (e.g. restaurants and bars, nursery, ATM machines, supermarket, post office, etc.?

- Is it cause control problem because of lack other services?

- Do you think uptec provide all facilities to companies incubated or research centers? facilities like orientation to innovation, entrepreneurship activities and sessions for marketing ideas and consultancy

- Do you integrate in your network venture capital companies (e.g., banks and venture capital funds)

- Is it lose control to your tenants?

- So in your criteria to accept tenants you accept only startups and firms with high potential growth?

- So do you have managerial control problems according to previously used criteria?

- In uptec do you think there is a lack of business expertise?

- Tenants (incubated companies) or research centers pay for what in uptec. For instance are they paid for space, services, consultation?
- Does this cause a control gap?

The following part will be on process gaps

- Do you have control problems according to Cultural barrier to networking?

- But you are working in organization with different people came from different background working in different companies within networks. So culture may be a barrier in networking?

- Do you have a certain scheme of activities to overcome cultural networking barriers? I.e. (seminars, conferences, meetings, breakfast/lunch seminars and meetings and also social and sport events and entertainment?

- Do you have mechanism for making informal networking?

-

- Are there any resistance from companies to learn new IT system? Or anything new?

- How you can control and manage this resistance?

- Do you give tenants too theoretical knowledge?

- Do you have a good scheduling helps in reducing the gap regarding the lack of time to attend courses and activities?

- Do you thinks it's better to have homogenous or heterogeneous tenants (in terms of activity, size, financing) etc.?

- But do you think If high level of homogeneous companies may lead to competition and destroy all networks and cooperation?

- What is the level of optimal heterogeneity?

- Identify the (formal and informal) means used to facilitate, strengthen or build relationships and synergies between enterprises, research centers, universities, intermediary organizations and public stakeholders
- (I will trying with her to draw all possible networks in UPTEC with both formal and informal)

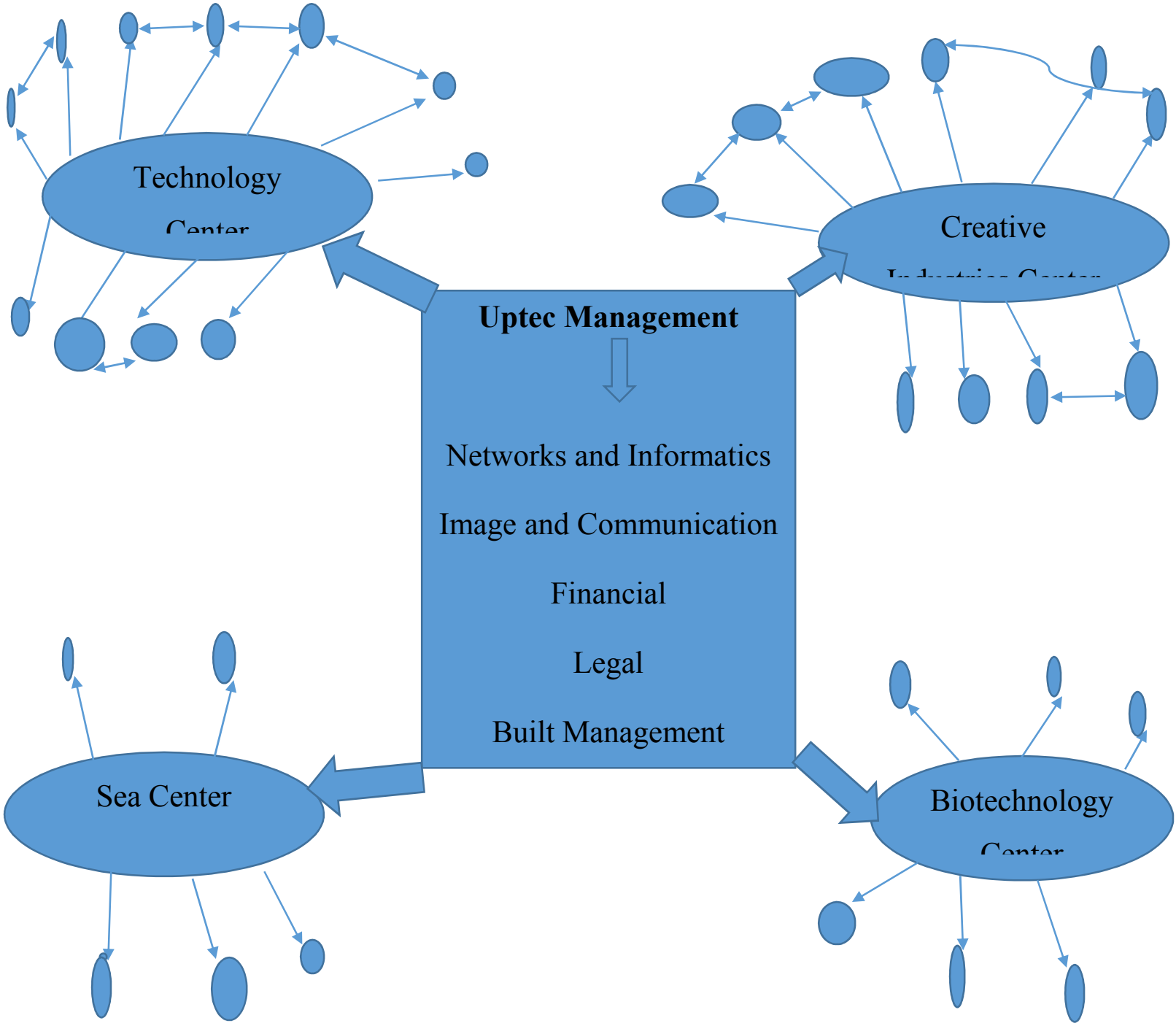
- Do you have any problems other than these ones?

What are formal controls like budgeting?

How can you measure performance in UPTEC?

What are key performance measures?

Do you have performance payments?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